CERTIFICATION

I, HUGH CHARLES WRIGHT of 3 Main Street, Kelfield, York YO19 6RG, England, am conversant with both the German and English languages.

I have translated German Patent application No. 103 131 70.1 (Exhibit 1 attached) into English (Exhibit 2 attached).

I hereby certify that the translation is correct to the best of my knowledge and ability.

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Dated: 3/8/07

Lock pin with pushbutton-operated axial locking and free bearing

The subject-matter of the invention is a lock pin with pushbutton-operated axial locking according to the introductory part of Claim 1. Lock pins of this type are used as machine elements. The pin part is inserted through a seat in a machine part so that it transfixes two machine parts possessing a common aligned bore. Pushbutton-operated spring-loaded locking elements are arranged at the forward free end of the pin part.

DE 10154692.0-24 originating from the same applicant, and constituting a prior right, describes a lock pin with pushbutton-operated axial locking according to the introductory part of Claim 1 wherein the locking elements are configured as catches. The same document also showed that the locking element can have a film hinge, provided that it is made from plastic material. Here, however, there are conflicting objectives, since on the one hand the material needs to be sufficiently flexible to form a serviceable film hinge, and on the other hand the locking elements need to have sufficient mechanical strength not to shear off while in locking engagement.

Known from the unrelated field of hinged dowels are shaft-mounted pivotable locking elements which are initially passed through a hole in a wall-opening in the folded-down position and are then deployed and pivoted into the locking position by means of a screw thread.

Such hinged dowels, however, are not suitable for the repeated operation required in the context of machine parts. In particular, they are not designed for fatigue loading, as the locking position usually has to be provided only once.

Incidentally, these unrelated catches lock in only one direction, whilst in the other direction, they are retractable.

Therefore the problem which lies at the basis of the invention is to develop a lock pin with pushbutton-operated axial locking of the kind stated at the outset so that it can be used repeatedly for machine elements, and is able to sustain high breaking loads and shear forces.

For the solution to this problem, the invention is characterized by the technical teaching of Claim 1. The essential feature of the invention is that the locking elements according to the invention have a rigid, rather than a flexible, design, and the hinge axle is designed as a virtual bearing-axle. Therefore a hinge pin that could become worn or even break under repeated flexing is no longer needed.

In a first preferred embodiment, the end of the pushrod forms a bearing shaft, while the catches themselves form bearing shells with a semi-circular configuration. This engineering design has proved effective. Nevertheless assembly is difficult where such a locking element is intended for use in through bores of less than 6 mm diameter.
In another configuration of the present invention, the bearing of the catch is shifted outwards to a plunger that has a semi-circular slot in which lobes, shaped as quadrants, of the two catches are carried.

Instead of the configuration shown, i.e. a lobe, the bearing of the catches may also be provided as a rib configured as a quadrant and extending over the full width.

In a third variant of the invention, the pushrod has an approximately rectangular recess in which the two catches are mounted. In this case the catches have separate, slightly outwards-displaced bearing-axles.

The recess can of course be located on the opposite side, e.g. by configuring accordingly a spring plunger like the one used in the second embodiment.

A further feature is that the pushrod is steadied on the other side by being “guided” in the above-mentioned spring-loaded plunger. At the same time, by resting on this plunger, the bearing-axles of the catches have a better mounting, that is to say, they are supported on both sides.

The pushrod may be guided in the plunger by a slot or an annular groove, or simply by guiding the pushrod externally or internally on the above-described recess.

The invention will now be described in detail with the aid of a drawing showing just one way of carrying out the invention. Further essential features and advantages of the invention will follow from the drawing and from its description.

In the drawings:

Figure 1	shows a section through a first embodiment of a lock pin according to the invention in the locked condition,
Figure 2	shows the view of Figure 1 in the unlocked condition,
Figure 3	is a perspective view of a locking element,
Figure 4	shows a section through a second embodiment of a lock pin in the locked condition,
Figure 5	shows the view of Figure 4 in the unlocked condition,
Figure 6	shows an enlarged view as Figure [4] but with spring omitted,
Figure 7	shows an enlarged view as Figure 5,
Figure 8	is a perspective view of the locking element,
Figure 9	shows a third embodiment of the invention, in section, in the locked condition,
Figure 10	shows the view of Figure 9 in the unlocked condition,
Figure 11	shows a modified form of the embodiment shown in Figure 9,
Figure 12	is a view from above of the embodiment of Figure 8, with the locking elements omitted,
Figure 13	is a perspective side view of a locking element,
Figure 14	shows a section through a fourth embodiment of a lock pin in the locked condition,

Figure 15 shows the view of Figure 14 in the unlocked condition,

Figure 16 shows, in section and on an enlarged scale, a modified form of the embodiment shown in Figure 14,

Figure 17 is an end view of the pushrod,

Figure 18 is a side view of the pushrod,

Figure 19 is a perspective view of a locking element for use in Figures 14 to 18.

The lock pin 1 shown in Figures 1 and 2 consists of an approximately cylindrical or square body 4 in whose central recess a pushrod 8 is longitudinally displaceably guided. As Figures 4 and 5 show, the pushrod 8 has at its upper end an operating button 23 which is displaceable relative to a bearing block 44 fixed with respect to the body of the pin. A circumferential recess 18 into which a cap 17 is latched by inwards directed projections 16 is arranged at the free, lower end of the body 4.

It is also feasible to provide the cap 17 with a screwed connection to the body 4, instead of the latched connection 16, 18.

The body 4 is extended downwards in the form of a bearing thimble 15. The circumferential recess 18 is located in this area.

A spring element 19 is contained inside the bearing thimble 15. This spring element 19 bears at one end on the bottom of the cap 17 and at the other end on the underside of two locking elements 2, 3 which point in opposite directions.

In the locked condition, each locking element 2, 3 sticks out of a recess 5. These recesses 5 are opposite each other and are approximately radially aligned.

According to the invention the bearing-axis of the two locking elements 2, 3 is pinless. That is to say, as shown in Figure 3, each locking element 2, 3 is configured as a one-sided bevel 7 which springs from an approximately rectangular locking body 6 and on the

forward, free end of which, two claws 9, 10, approximately semi-circular in shape and spaced apart from each other, are formed.

A gap 11 is formed between the two claws; and the space between the claws 9, 10 of one locking element 2 forms a bearing shell 14 for the opposite locking element 3 (not shown in the drawing), which engages by a single, likewise semi-circular, claw into the gap 11 between the claws 9, 10 of the locking element 2.

Thus, the two locking elements 2, 3 fit together in the region of a common bearing shell 14, so forming the said virtual hinge-axle/shaft 12.

As Figure 1 shows, the pushrod 8 reaches into the two locking elements by its lower end, which is configured as a blade 13.

It can be seen from Figure 1 how the claw 20 on the locking element 3 engages in the gap 11 between the claws 9, 10 of the locking element 2.

Upon operation of the pushbutton 23, the pushrod 8 is pushed down against the spring element 19, and the two locking elements 2, 3 are tilted downwards in the recess 5, producing the unlocked position shown in Figure 2.

Figure 1 also shows the central recess 31 in the bearing thimble 15 in which the spring element 19 is mounted.

Instead of a helical compression spring, any other known stored-energy device such as elastomer springs, leg springs or spiral springs can, of course, be used.

Upon operation of the pushrod 8, the virtual bearing-axle between the two locking elements 2, 3 therefore undergoes an axial displacement in the direction of the arrow 21 of Figure 3.

Instead of forming the hinge-axle 12 by the interlocking claws 9, 10, 20, Figures 4 to 7 show a different embodiment.

Here, as shown in Figures 4 to 8, the bearing-axle is defined by forming a guide web 27, approximately in the shape of a quadrant, on each locking element 32, 33.

Each locking element 32, 33 again consists of an approximately rectangular solid body, with a bevel 26 at its inner end. The bevel 26 tapers to a stop fin 28 on the end face.

Both guide webs 27 of the locking elements 32, 33 engage in a guide slot 29 in a bearing plunger 24, as shown in Figure 6.

In Figures 6 and 7 the spring element 19 has been omitted in order to simplify the drawing.

Nevertheless Figure 6 shows that when the bearing plunger 24 is in the raised position it bears, by a radially outwards directed shoulder 25 with increased diameter, on the underside of the locking elements 32, 33 pointing radially in opposite directions.

Upon operation of the pushrod 8, the blade 13 of the pushrod 8 moves into the gap between the two locking elements 32, 33 and strikes both stop fins 28.

This causes the two locking elements 32, 33 to tilt in the recess 5 concurrently with the axial downward displacement of the bearing plunger 24, as shown in Figure 7.

Thus in the lock pin 30 shown in Figures 4 to 8 the virtual pivot-bearing between the two locking elements 32, 33 is formed by a pivoting bearing of each guide web 27 in a guide slot 29 in a bearing plunger 24 that is axially guided under spring loading.

It will be obvious that additional axial guidance of the bearing plunger 24 can also be provided in the region of the recess 31.

Such axial guidance of the bearing plunger 24 can thus be provided in the region of both the surrounding bearing thimble 15 and of the bearing shell 14.

The advantage of this arrangement is that it, too, provides a pinless pivot-bearing between the locking elements 32, 33. This pivot-bearing therefore works with little or no wear and can be rated for a high number of load cycles.

Although the guide web 27 of Figure 8 on the underside of each locking element 32, 33 is relatively narrow, it can, in another embodiment, be made wider. The width of the guide web can also be matched to that of the locking element 32, 33.

In the further embodiment shown in Figures 9 to 13, an approximately rectangular recess is formed at the lower end of the pushrod 8 between two parallel, endwisely- arranged fork-extensions 38.

Somewhat pin-like, round-profiled bearing-axles 37, which are straddled by the fork-extensions 38, are arranged at the inward ends of the two locking elements 34, 35.

The bearing-axles 37 press on the shoulder 25 of increased diameter which is joined to the spring-loaded axially displaceable bearing plunger 36.

Thus, when pressure is applied to the pushrod 8, the bearing plunger 36 is displaced downwards into the region of the cap 17, against the force of the spring element 19, and the two locking elements 34, 35 pivot inwards into the unlocked position.

Incidentally, Figure 13 shows that the locking elements 34, 35 can have slots 41 instead of being joined to bearing-axles 37.

The fork-extensions 38 of the pushrod 8 engage in these slots 41 so that here, too, a virtual pivot-bearing of the locking elements 34, 35 manifests itself.

The locking elements 34, 35 are thereby juxtaposed in the region of their bevels 26, as shown in Figure 10.

As Figures 9 and 10 show, the bearing plunger 36 is guided axially, and prevented from skewing, in the bearing thimble 15 on the opposite side to the pushrod 8. For this purpose the shoulder 25 of the bearing plunger 36 has radially outwards directed extensions 39 affording linear guidance on the bearing thimble 15.

The bearing-axles thereby created on the locking elements 34, 35 are thus supported in all directions.

In a modified embodiment shown in Figures 14 to 19, the fork-extensions 38 described above with reference to Figure 11 can also be axially extended, and can engage in seats 42 in the region of the spring-loaded axially-guided bearing plunger 43. This provides trouble-free axial longitudinal guidance of the bearing plunger 43 in the lock pin 40 shown in Figures 14 and 15.

In a similar embodiment to Figures 9 to 13, the fork-extensions 38 can in this case too engage in slots 41 in the opposite-way locking elements 34, 35, so replacing the bearing-axles 37 formed on the locking elements 34, 35 as shown in Figure 16. Figure 19 illustrates this.

A feature common to all embodiments is that a pinless pivot-bearing of the locking elements 2, 3; 32, 33; 34, 35 is shown, and that the locking elements, as rigid, rather than flexible, bodies, have an excellent locking action combined with good resistance to shear forces.

Drawing legend

1	lock pin	23	operating button
2	locking element	24	bearing plunger
3	locking element	25	shoulder
4	body	26	bevel
5	recess	27	guide web
6	locking body	28	stop web
7	bevel	29	guide slot
8	pushrod	30	lock pin
9	claw	31	recess
10	claw	32	locking element
11	gap	33	locking element
12	pivot axle	34	locking element
13	blade	35	locking element
14	bearing shell	36	bearing plunger
15	bearing thimble	37	bearing-axle
16	projection	38	fork-extension
17	cap	39	extension
18	recess	40	lock pin
19	spring element	41	slot
20	claw	42	seat
21	direction arrow	43	bearing plunger
22	bearing shell (of 2,3)	44	bearing block

Claims

1. Lock pin with pushbutton-operated axial locking, wherein the lock pin has a tubular body in whose interior an actuating plunger axially displaceable under spring loading is accommodated and which is configured as a pressure part which acts on two locking elements (2, 3; 32-35) pointing in opposite directions which are mounted in radially outwards directed recesses (5) in the body (4), **characterized in that** the locking elements (2, 3; 32-35) form a virtual, freely guided pivoting axle (12) in their connection zone (9, 10, 11, 20; 27, 29; 37).

2. Lock pin according to Claim 1, **characterized in that** the locking elements (2, 3; 32-35) are configured as rigid, inflexible bodies.

3. Lock pin according to Claims 1 and 2, **characterized in that** the pivoting axle (12) freely guided between the locking elements (2, 3) consists of a bearing shell (14) configured between the locking elements (2, 3), into which the pushrod (8) engages (Figures 1-3).

4. Lock pin according to Claims 1 and 2, **characterized in that** the freely guided pivoting axle (12) configured between the locking elements (32, 33) is configured in a bearing plunger (24) displaceably guided under spring loading, in which the two locking elements (32, 33) pivotably engage, each by a guide web (27) (Figures 4-8).

5. Lock pin according to Claim 4, **characterized in that** the locking element (32, 33) consists of a block-shaped or rectangular body on the underside of which a guide web (27), approximately in the shape of a quadrant, is formed which engages pivotably in a guide slot (29) in the bearing plunger (24) (Figures 4-8).

6. Lock pin according to Claim 4 or Claim 5, **characterized in that** the bearing plunger (24) has an axial longitudinal guide in the lock pin (1).

7. Lock pin according to any one of Claims 1 to 6, **characterized in that** the bearing-axles (37) of the locking elements (34, 35) are formed by approximately round-profile pins formed on the inwards-facing ends of the locking elements (34, 35) and pivotably

engaging in recesses in the bearing plunger (36) displaceable under spring loading (Figures 9-19).

8. Lock pin according to any one of Claims 1 to 6, **characterized in that** the bearing-axles (37) of the locking elements (34, 35) are formed by approximately round-profile pins formed parallel and spaced apart on the forward, free end of the pushrod (8) and engaging pivotably in slots (41) in the end faces of the locking elements (34, 35) (Figures 9-19).

9. Lock pin according to Claim 8, **characterized in that** the pushrod (8) has on its forward, free end two parallel fork- extensions (38) bounding a recess in which the two bearing-axles (37) of the locking elements (34, 35) are pivotably held and in that the fork-extensions (38) engage in seats (42) in the bearing plunger (43) guided under spring loading, and are thereby guided (Figures 16-18).

Abstract

A lock pin with pushbutton-operated axial locking has two locking elements which point in opposite directions and are mounted in radially outwards directed recesses in the body. To ensure a good, wear-resistant pivotal mounting of the two locking elements, combined with good locking action and resistance to shearing, the invention provides that the locking elements create a virtual, freely guided pivoting axis in their connection zone. The result is a pinless mounting of the locking elements.